



# ICAO ENGINE nvPM EMISSIONS DATA SHEET

## SUBSONIC ENGINES

|                        |                  |                                |      |
|------------------------|------------------|--------------------------------|------|
| ENGINE IDENTIFICATION: | PW1519G          | BYPASS RATIO (-):              | 11.6 |
| UNIQUE ID NUMBER:      | 04F20PW199       | PRESSURE RATIO $\pi_{co}$ (-): | 32.3 |
| COMBUSTOR:             | TALON X, Block-C |                                |      |
| ENGINE TYPE:           | TF               | RATED OUTPUT $F_{oo}$ (kN):    | 88.0 |

### REGULATORY DATA

| CHARACTERISTIC VALUES:                     | $LTO_{mass}/F_{oo}$<br>(mg/kN) | $LTO_{num}/F_{oo}$<br>(particles/kN) | NVPM MASS CONCENTRATION<br>( $\mu\text{g}/\text{m}^3$ ) |
|--|--------------------------------|--------------------------------------|---|
| LTO/ $F_{oo}$ AND MAX nvPM <sub>mass</sub> | 6.7                            | 3.86E+14                             | 190   |
| AS % OF CAEP/10 LIMIT                      | -                              | -                                    | 2.7   |
| AS % OF CAEP/11 LIMIT (InP)                | 0.3                            | 2.3                                  |   |
| AS % OF CAEP/11 LIMIT (NT)                 | 1.0                            | 5.0                                  |   |

### MEASURED DATA

| MODE  | POWER SETTING<br>(% $F_{oo}$ ) | TIME<br>minutes | FUEL FLOW<br>kg/s | EMISSIONS INDICES*            |                                     | NVPM MASS CONCENTRATION<br>PEAK nvPM <sub>mass</sub><br>( $\mu\text{g}/\text{m}^3$ ) |
|---|--------------------------------|-----------------|-------------------|-------------------------------|-------------------------------------|--|
|   |                                |                 |                   | EI <sub>mass</sub><br>(mg/kg) | EI <sub>num</sub><br>(particles/kg) |  |
| TAKE-OFF  | 100                            | 0.7             | 0.623             | 6.3                           | 1.77E+14                            |  |
| CLIMB OUT   | 85                             | 2.2             | 0.520             | 2.5                           | 1.18E+14                            |  |
| APPROACH  | 30                             | 4.0             | 0.191             | 0.1                           | 1.82E+13                            |  |
| IDLE  | 7                              | 26.0            | 0.067             | 0.8                           | 1.04E+14                            |  |
| LTO TOTAL (kg, mg, number of particles)   |                                |                 | 246               | 425                           | 2.44E+16                            | -  |
| NUMBER OF ENGINES   |                                |                 |                   | 1                             | 1                                   | 1  |
| NUMBER OF TESTS   |                                |                 |                   | 3                             | 3                                   | 3  |
| AVERAGE LTO/ $F_{oo}$ VALUES (mg/kN, particles/kN)                                  |                                |                 |                   | 4.8                           | 2.78E+14                            | -  |
| MAX EI VALUES (mg/kg, particles/kg) AND MAX MASS CONC. ( $\mu\text{g}/\text{m}^3$ ) |                                |                 |                   | 6.3                           | 1.77E+14                            | 147  |

\* Emissions Indices are corrected for thermophoretic loss and fuel hydrogen content

### DATA FOR EMISSIONS INVENTORIES (ESTIMATIONS FOR ENGINE EXIT PLANE VALUES)

| MODE      | POWER SETTING<br>(% $F_{oo}$ ) | CORRECTED EMISSIONS INDICES      |  |
|-----------|--------------------------------|----------------------------------|--|
|           |                                | EI <sub>mass_SL</sub><br>(mg/kg) | EI <sub>num_SL</sub><br>(particles/kg) |
| TAKE-OFF  | 100                            | 8.8                              | 8.99E+14                               |
| CLIMB OUT | 85                             | 4.1                              | 7.73E+14                               |
| APPROACH  | 30                             | 0.2                              | 8.66E+13                               |
| IDLE      | 7                              | 1.5                              | 8.42E+14                               |

### AMBIENT CONDITIONS

|                                | From   | To     | FUEL                          |       |
|--------------------------------|--------|--------|-------------------------------|-------|
|                                |        |        | HEAT OF COMBUSTION (MJ/kg)    |       |
| BAROMETER (kPa)                | 102.0  | 103.3  | HYDROGEN CONTENT (%mass)      | 13.98 |
| TEMPERATURE (K)                | 272.0  | 278.1  | AROMATICS CONTENT (%vol)      | 18.1  |
| HUMIDITY (kg water/kg dry air) | 0.0012 | 0.0022 | NAPHTHALENE CONTENT (%vol)    | 0.78  |
|                                |        |        | SULPHUR CONTENT (ppm by mass) | 553   |

|                    |                                   |
|--------------------|-----------------------------------|
| MANUFACTURER:      | Pratt & Whitney                   |
| TEST ORGANIZATION: | Pratt & Whitney                   |
| TEST LOCATION:     | Mirabel Aerospace Centre - Quebec |
| TEST DATES:        | 25/03/2018-26/03/2018             |

### REMARKS

1. Data from certification report PWA-12245-02
2. Block C combustor
3. nvPM levels in accordance with Annex 16 Vol. II, Chapter 4, Appendix 7 and Appendix 8.
4. Data revised: nvPM EI<sub>mass\_SL</sub> corrected